REMARKS

Claims 2-3 and 5-10 stand rejected under 35 U.S.C. § 103 as unpatentable over Auty in view of Subbarao.

The examiner's rejections are respectfully traversed.

The examiner has cited the primary reference of Auty for disclosing the plurality of cameras having different resolutions and the conversion means as recited in applicant's claims. The examiner states that figure 17 teaches the conversion means together with the disclosure in column 20, lines 29-67 and column 21, lines 1-63. Further, the examiner states that Auty discloses well-known concepts of computing a distance of the object as set forth in column 7, lines 1-39 and column 21, lines 59-63.

Auty does not disclose applicant's specifically recited conversion means for converting the images outputted from the cameras into converted images whose pixel units are equal in the amount of object represented thereby. Indeed, Auty discloses the utilization of two cameras, a vehicle detection camera 6, which is a wide-angle camera of medium resolution, and an image acquisition camera 8, which is a high-resolution camera. The vehicle detection camera 6 has a field of view 12 illustrated, for example, in figure 3, and the image acquisition camera 8 has a field of view 20, also illustrated in figure 3. The vehicle-detection camera 6 processes the image signals from the vehicle 18 when it is traveling within its field of view 12 and, at a pre-determined location, triggers the operation of the image-acquisition camera 8, so that the image-acquisition camera 8 may take a high-resolution image of the object 18 to obtain detail identifying information such as the license plate of the vehicle and the like. Vehicle detection camera 6 is utilized to preliminarily identify and sort the type of vehicle and to calculate its speed so as to determine at what time it will reach the image acquisition point 22 (see figure 3) in order to timely activate the image acquisition camera 8.

The transformations identified by the examiner at column 20, lines 29-67 and column 21, lines 1-63, appear to be implemented by the data-processing apparatus shown in figure 8, with respect to the vehicle detection camera 6 since it is the vehicle detection camera 6 that is utilized to track the speed and trajectory of the vehicle 18 as it moves through its wide field of view 12. In contrast, the image acquisition camera 18 is utilized to

take a snapshot of the vehicle 18 at the acquisition point 22, and does not appear to be utilized for further speed/trajectory calculations.

The transformations discussed in columns 20 and 21 are meant to compensate for the non-linearity of the cluster representing the image 18 as it moves through the field of view 12 of the vehicle detection camera 6 as viewed from the image plane coordinates of the vehicle detection camera 6. The underlying reason for the non-linearity is due to the angle or perspective of the object 18 as viewed by the image plane coordinates of the camera 6. The objective of the transformation is to convert this image plane coordinate image into real-world 3-D coordinates as represented by figure 25 and the results of the transformation are shown in figure 27. Figure 27 illustrates that the vehicle is moving at a constant speed in the left-hand lane approaching camera 6.

As is clear from the above discussion, Auty does not disclose a conversion means for converting the images outputted from the cameras into converted images whose pixel units are equal in the amount of object represented thereby. No such conversion is taught. Indeed, the conversion appears to be only described in relation to camera 6, which provides the vehicle data detection.

In order to even more clearly differentiate applicant's invention from the Auty teaching, applicant has amended claim 2, for example, to make it clear that the conversion means is for converting the images outputted from "each" of the plurality of cameras into converted images whose pixel units are equal in the amount of object represented thereby. The plurality of cameras, of course, corresponds to cameras which produce images of the object from different angles and have different resolutions from each other. Thus, Auty must disclose the same conversion with reference to its cameras 6 and 8. However, as indicated above, the conversion discussed in columns 20 and 21 has nothing to do with converting the images from Auty's cameras 6 and 8 into converted images whose pixel units are equal in the amount of object represented thereby. Indeed, the conversion appears to apply only to camera 6, but even if it applied to both cameras 6 and 8, the conversion simply does not provide the same images which have pixel units equal in the amount of object represented thereby.

Thus, the fundamental basis for the rejection applying the primary reference of Auty is fatally defective and does not disclose the conversion means as recited in applicant's

claims, particularly, as made clear by the present amendment, that such conversion means must operate on each of the different cameras.

The secondary reference of Subbarao, even if combined with Auty, does not produce applicant's invention. As indicated above, Auty does not disclose applicant's specifically recited conversion means and thus, even assuming Subbarao discloses distance measurements utilizing stereo imaging, the combination of Auty and Subbarao does not make out a *prima facie* case of obviousness under the provisions of 35 U.S.C. § 103.

All of applicant's independent claims have been amended in order to make it clear that the conversion means is performed with respect to each of the plurality of cameras. As such, it is respectfully submitted that all of applicant's claims are clearly patentable over the prior art.

The application is now believed to be in condition for allowance and an early indication of same is earnestly solicited.

Respectfully submitted,

Date: October 12, 2001

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RECEIVED OCT 17 2001 Technology Center 2600

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Attorney Docket No. 067183-0157

In re patent application of

Gregory HOUSE

Group Art Unit: 2613

Serial No. 08/962,315

Examiner: S. An

Filed: October 31, 1997

For: THREE-DIMENSIONAL STRUCTURE ESTIMATION APPARATUS

MARKED-UP COPY OF AMENDMENT IN REPLY TO OFFICE ACTION OF JULY 16, 2001

Commissioner for Patents
Washington, D.C. 20231

Commissioner:

In reply to the office action mailed July 16, 2001, please amend the above identified application as follow:

IN THE CLAIMS:

Claims 2-3 and 5-10 are amended as shown below:

2. (Three Times Amended) A three-dimensional structure estimation apparatus which measures a distance to an object, comprising:

a plurality of cameras for producing images of the object from different angles and having different resolutions from each other;

conversion means for converting the images outputted from each of said plurality of cameras into converted images whose pixel units are equal in the amount of object represented thereby; and

a depth image production section for comparing the converted images using stereo imaging to calculate a distance to the object.

3. (Three Times Amended) A three-dimensional structure estimation apparatus which measures a distance to an object, comprising:

a plurality of first cameras for producing images of the object from different angles and having different resolutions from each other;

a plurality of second cameras for producing images of the object from different angles and having different visual fields from each other;

conversion means for converting the images outputted from said first and second cameras into converted images whose pixel units are equal in the amount of object represented thereby; and

a depth image production section for comparing the converted images using stereo imaging to calculate a distance to the object.

5. (Three Times Amended) A three-dimensional structure estimation apparatus which measures a distance to an object, comprising:

a plurality of cameras for producing images of the object from different angles and having different resolutions from each other;

conversion means for converting the images produced by each of said plurality of cameras into converted images whose pixel units are equal in the amount of object represented thereby by parallel movement by different movement amounts; and

a depth image production section for comparing the converted images using stereo imaging to calculate a distance to the object.

6. (Three Times Amended) A three-dimensional structure estimation apparatus which measures a distance to an object, comprising:

a plurality of first cameras for producing images of the object from different angles and having different resolutions from each other;

a plurality of second cameras for producing images of the object from different angles and having different visual fields from each other;

conversion means for converting the images produced by said first and second ~~said~~ plurality of cameras into converted images whose pixel units are equal in the amount of object represented thereby by parallel movement by different movement amounts; and

a depth image production section for comparing the converted images using stereo imaging to calculate a distance to the object.

7. (Three Times Amended) A three-dimensional structure estimation apparatus which measures a distance to an object, comprising:

a plurality of cameras for producing images of the object from different angles and having different resolutions from each other;

a conversion unit for converting the images outputted from each of said plurality of cameras into converted images whose pixel units are equal in the amount of object represented thereby; and

a depth image production section for comparing the converted images using stereo imaging to calculate a distance to the object.

8. (Three Times Amended) A three-dimensional structure estimation apparatus which measures a distance to an object, comprising:

a plurality of first cameras for producing images of the object from different angles and having different resolutions from each other;

a plurality of second cameras for producing images of the object from different angles and having different visual fields from each other;

a conversion unit for converting the images outputted from said plurality of first and second cameras into converted images whose pixel units are equal in the amount or object represented thereby; and

a depth image production section for comparing the converted images using stereo imaging to calculate a distance to the object.

9. (Three Times Amended) A three-dimensional structure estimation apparatus which measures a distance to an object, comprising:

a plurality of cameras for producing images of the object from different angles and having different resolutions from each other;

a conversion unit for converting the images produced by each of said plurality of cameras into converted images whose pixel units are equal in the amount of object represented thereby by parallel movement by different movement amounts; and

a depth image production section for comparing the converted images using stereo imaging to calculate a distance to the object.

10. (Three Times Amended) A three-dimensional structure estimation apparatus which measures a distance to an object, comprising:

a plurality of first cameras for producing images of the object from different angles and having different resolutions from each other;

a plurality of second cameras for producing images of the object from different angles and having different visual fields from each other;

a conversion unit for converting the images produced by said first and second ~~said~~ plurality of cameras into converted images whose pixel units are equal in the amount of object represented thereby by parallel movement by different movement amounts; and

a depth image production section for comparing the converted images using stereo imaging to calculate a distance to the object.